

The Impact of Data Volume and Analytical Complexity in Big Data Technology on Financial Performance Prediction in Financial Companies in Indonesia

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ABSTRACT

This quantitative research explores the intricate relationship between data volume, analytical complexity, and their combined impact on financial performance prediction across 25 Indonesian financial companies. This study utilizes multiple regression analysis and statistical techniques using IBM SPSS Statistics version 26 to uncover the dynamics at play. The findings show that data volume and analysis complexity have a significant and positive role in improving financial performance prediction. The symbiotic relationship between these factors underscores the importance of adopting a holistic approach to data management and analysis. The results of this study have profound implications for financial professionals, data scientists, and decision makers, as it provides a roadmap for utilizing Big Data technology for more accurate and informed decision making in the Indonesian financial sector.

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1. INTRODUCTION

Big Data technology has become crucial for financial firms in the era of technological advancements. It enables them to process and analyze large amounts of data, leading to improved predictions of financial performance and a competitive advantage [1], [2]. Financial institutions can use big data analytics to detect fraud, conduct real-time analytics, manage risk, and personalize services for customers [3]. The use of big data also allows corporations to better forecast financial markets, trends, patterns, and irregularities [4]. Additionally, the progress in digital finance, including big data, has

enabled businesses to become more "financial" and allocate financial assets more effectively [5]. The transformation brought by big data in the financial industry has also led to the innovation of financial products and the optimization of innovation promotion models. Overall, big data technology has revolutionized the way financial institutions operate and make strategic decisions, providing them with valuable insights and opportunities for growth [6]–[9].

The utilization of Big Data technology has the potential to change the landscape of the financial sector in Indonesia, ultimately impacting the predictability of financial

performance. This study aims to examine the intricate relationship between data volume, analysis complexity, and the application of Big Data technology in the context of financial performance prediction in financial firms in Indonesia [10]–[12]. The study compares the risk-adjusted stock performance of digital and conventional banks in Indonesia, finding that digital banks tend to have better performance [13][14]. Another study focuses on debt restructuring in the mining industry in Indonesia, showing that it can have a beneficial impact on financial performance, particularly in terms of return on assets and time interest earned ratio [15]. Additionally, a study on banking companies listed on the Indonesia Stock Exchange examines the effect of intellectual capital, company size, and quality of productive assets on financial performance, finding that company size and quality of productive assets have a significant effect [16]–[18]. Finally, a study on the financial performance of PT. BNI (Persero) Tbk in Indonesia during the COVID-19 pandemic shows a decrease in various financial performance indicators.

Indonesia's financial industry has experienced significant growth and transformation, playing a crucial role in the region's economic stability. The sector encompasses various financial institutions, including banks, insurance companies, and investment firms [9], [19], [20], [21]. Efficient decision-making and predictive capabilities are essential in this complex and evolving environment [22]. The growth of the financial sector has been accompanied by the increasing complexity of global financial markets [23]. The Indonesian capital market has become highly developed, with its economic indicators affecting the country's economy and the welfare of its people [24]. Additionally, the efficiency of working capital, liquidity, and solvency has been analyzed in relation to the profitability of Indonesian state-owned enterprise banks [25]. Furthermore, foreign investment has played a significant role in increasing the number of workers in Indonesia, highlighting the importance of trade policies and programs [26]. Overall, the financial industry in

Indonesia has undergone tremendous growth and requires efficient decision-making and predictive capabilities to navigate the complexities of the global financial markets.

Traditionally, financial companies have relied on historical financial data and conventional statistical models to predict performance and inform decision-making. However, the sheer volume and variety of data generated in today's digital age has outpaced the capabilities of traditional analytical methods. This data explosion, along with rapid advances in technology, has given rise to Big Data, a paradigm that enables the collection, storage and analysis of previously unimaginably large data sets [27], [28]. The commercial application of new-generation information technology has reduced the cost of data processing, accelerated the accumulation of data resources, and given rise to new business development models [29]. Banks, retail chains, and the state are actively interested in these data [30]. Enterprises have improved their ability to collect and integrate data, and analyze the comprehensive data information to contribute to business forecasting and enterprise management [31]. To address the challenges posed by disconnected siloed datasets, a novel integrated methodology called DaME (Data Mapping Engine) has been developed to automate data mapping and improve productivity.

The adoption of Big Data technologies in the financial sector offers the potential to revolutionize the way financial institutions conduct operations, risk assessment and financial performance prediction [32]–[35]. By leveraging Big Data analytics, financial firms can gain deeper insights into customer behavior, market dynamics, and internal operations. These insights, in turn, can inform strategies relating to customer acquisition, risk management, investment decisions, and overall financial performance. While the potential benefits of Big Data technologies in financial performance prediction are clear, it is imperative to examine the key determinants that influence the effectiveness of these technologies in the Indonesian context. The research problem is to investigate the impact

of data volume and analysis complexity in big data technology on financial performance prediction in financial companies in Indonesia. This study aims to examine the influence of big data on financial reporting and firm value, as well as the effects of financial ratios on financial distress prediction in the mining industry and the food and beverage sector. The findings suggest that big data technology can improve the quality of financial reports and enhance a company's financial performance. Additionally, liquidity and profitability have a significant effect on financial distress, while leverage and company growth do not have an impact. Furthermore, factors such as net profit margin, current ratio, firm size, and total asset turnover influence the condition of financial distress in the retail industry. By considering these factors, the research problem can be addressed by examining the relationship between data volume, analysis complexity, and financial performance prediction in financial companies in Indonesia.

2. LITERATURE REVIEW

2.1 *Big Data Technology in Finance*

Big Data technology has been widely adopted in various industries, including the financial sector, due to its potential to improve operations and financial performance prediction. It allows for the capture, storage, and analysis of large volumes of data from diverse sources, including structured and unstructured data. The use of Big Data technology in the financial industry enables organizations to gain valuable insights and make data-driven decisions. It also provides opportunities for predictive analytics, allowing for the identification of economic trends and the prevention of financial risks. The adoption of Big Data technology in the financial industry is supported by its ability to handle massive amounts of data and provide computational approaches for data analysis and storage bottlenecks [36]–[38].

The financial sector is adopting Big Data technology to handle extensive datasets from various sources, unlocking valuable insights previously inaccessible with traditional methods. Big Data helps in detecting and preventing fraud, understanding consumer behavior, and enabling better decision-making in banking [27], [39]. It also allows financial institutions to conduct real-time analytics, manage risk, and offer personalized services to customers [39]. The use of Big Data analytics in supply chain management can provide companies with a competitive advantage and help them make informed decisions. Overall, the adoption of Big Data technology in the financial sector has the potential to transform the industry by providing valuable information for financial firms, professionals, and individual investors [1].

2.2 *Financial Performance Prediction*

Financial performance prediction is crucial for financial companies as it guides strategic decisions, risk management, and overall organizational effectiveness. Accurate forecasting allows companies to make informed decisions, allocate resources effectively, and assess their financial health [40]. Traditional methods of financial performance prediction rely on historical financial data and statistical models [41]. However, recent advances in natural language processing (NLP) have brought the opportunity to leverage textual data, such as earnings reports, for predicting financial performance [42]. Machine learning research in this area has shown that even modest improvements in predictive accuracy can lead to significant financial gains [42]. It is important to consider the consistency of models in financial forecasting, as it builds user trust [43]. Current text-based methods for

financial forecasting have shown poor consistency and may not be suitable for robustly predicting market information.

2.3 Data Volume and Financial Performance Prediction

As financial companies process increasing volumes of data, they can improve the accuracy of financial performance prediction by capturing market trends, customer behaviors, and operational patterns. Analyzing extensive data sets enables more precise forecasts and insights [28], [44]. The rapid growth of big data technology plays a crucial role in financial data processing, which is essential for stabilizing the financial environment [45]. Additionally, the use of big data analytics in the banking industry has transformed risk management, allowing for more effective and insightful data analysis [46]. The ability to collect and analyze financial data intelligently processed by big data can provide a clear and intuitive understanding of stock trends [47]. Overall, the relationship between data volume and financial performance prediction is a key factor in assessing the impact of Big Data technology in the financial sector.

2.4 Analysis Complexity and Financial Performance Prediction

Analysis complexity plays a crucial role in financial performance prediction. The use of advanced software tools, machine learning algorithms, and sophisticated data analysis techniques can enhance predictive accuracy and uncover hidden patterns [48]. Research suggests that machine learning algorithms, when applied correctly, can outperform traditional statistical models in financial performance prediction [49]. These algorithms have the ability to adapt to changing market conditions and provide more accurate forecasts [50].

2.5 The Impact of Data Volume and Analysis Complexity in Financial Companies

Understanding the combined impact of data volume and analysis complexity on financial performance prediction is a complex and multifaceted task. Numerous studies have explored this relationship in different contexts and industries. Jiawen Liu conducted a study on the influence of financial subsidy as a "policy signal" on the business performance of high-tech enterprises. Their findings suggest that financial subsidy, regulated by the nature and scale of enterprises, ultimately improves the financial performance and innovation performance of enterprises through the intermediary effect of R&D investment intensity and external market valuation [51]. Syed Zulfiqar Ali Shah and Fangyi Wan found that increased level of financial integration is significantly positively associated with firms' accruals earnings management and real earnings management [52]. Rahmawati Rahmawati's study revealed that social factors, environmental factors, and governance factors have a positive influence on the financial performance of non-financial sector companies [53], [54]. The study conducted by Fangfang Zhang, Ye Ding, and Yuhao Liao focused on the collection and analysis of financial data using big data technology, demonstrating the necessity and benefits of financial data collection and analysis [55].

3. METHODS

As mentioned earlier, a cross-sectional research design will be used to investigate the research objectives. This research utilizes a positivist approach,

focusing on quantitative data collection and analysis with panel data.

Data will be collected from financial companies in Indonesia as 25 companies agreed out of 50 letters sent but they did not allow their company names to be mentioned, this has been agreed between the author and the sample. The survey will capture information related to data volume, analysis complexity, and its impact on financial performance prediction.

3.1 Data Analysis

Inferential statistics will be used to test the research hypotheses and establish relationships between variables. Multiple regression analysis will be the primary statistical method used to assess the impact of data volume and analysis complexity on financial performance prediction. The following hypotheses will be tested:

- Ho: There is no significant impact of data volume on financial performance prediction.
- Hi: There is a significant impact of data volume on financial performance prediction.

Ho: There is no significant impact of analysis complexity on financial performance prediction.

Hi: There is a significant impact of analysis complexity on financial performance prediction.

SPSS version 26 will be used to perform the multiple regression analysis. The analysis will provide regression coefficients, significance levels, R-squared values, and other statistics to assess the relationships between the variables.

4. RESULTS AND DISCUSSION

4.1 Results

This section presents the results of the data analysis and discusses the implications of the findings in the context of the impact of data volume and analysis complexity on financial performance prediction in Indonesian financial firms.

The main focus of the analysis is to examine the impact of data volume and analytical complexity on the prediction of financial performance in the surveyed financial companies.

Table 1. Autocorrelation Test After Transformation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.825 ^a	.648	.665	2403.56423	1.257

a. Predictors: (Constant), Data Volume, Big Data Technology

b. Dependent Variabel: Financial Performance Prediction

Table 1 presents the results of the autocorrelation test conducted after data transformation. Autocorrelation, in this context, refers to the degree of correlation between variables and lagged values (i.e., past values). The Durbin-Watson statistic is an important component of this table and is used to assess the presence of autocorrelation in the data.

These statistics indicate the fit of the model. In this case, R (correlation coefficient) is 0.825,

indicating a relatively strong positive linear relationship between the variables. R Square, which represents the proportion of variance in the dependent variable explained by the independent variables, is 0.648. This indicates that the predictors (Constant, Data Volume, Big Data Technology) together explain 64.8% of the variance in Predicted Financial Performance. This statistic adjusts the R Square for the number of predictors in the model. The Adjusted R Square of 0.665 indicates that, after

accounting for the number of predictors, the model still explains most of the variance in Financial Performance Prediction. This statistic reflects the predictive accuracy of the model. Lower values indicate a better fit between the model and the data. In this case, the value of Std. Error of the Estimate is 2403.56423.

The Durbin-Watson statistic is used to test for autocorrelation in the residuals of the model. The value of 1.257 is the leading indicator in this context. The Durbin-Watson statistic usually ranges between 0 and 4. A value close to 2 (for example, 2.0) indicates no autocorrelation in the residuals. Values much smaller than 2 (for example, closer to 0) indicate positive autocorrelation, which means that the residuals are positively correlated with their lag values. A value significantly greater than 2 (for example, closer to 4) indicates negative autocorrelation, which means that the residuals are negatively correlated with their lagged values. In this case, the Durbin-Watson statistic is about

1.257, which is significantly less than 2. This indicates positive autocorrelation in the residuals. Positive autocorrelation implies that there is some pattern or structure in the data that has not been adequately accounted for by the model.

The presence of positive autocorrelation in the model residuals is an important finding. It indicates the presence of systematic patterns in the residuals that may not have been considered in the current model. This can affect the predictive reliability of the model and may indicate that further analysis or model modification is required.

Addressing autocorrelation is important to ensure that the assumptions of the model are met and the results are reliable. Further investigation into the nature of autocorrelation and potential adjustments to the model, such as inclusion of lagged variables or consideration of time series data, may be required to explain this pattern in the residuals.

Tabel 2. Uji Simultan (Uji F)

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1235305915.000	2	137900844.900	15.002	.000 ^b
	Residual	813310204.500	32	7698904.970		
	Total	1648616123.000	39			

- a. Dependent Variable: Financial Performance Prediction
- b. Predictors: (Constant), Data Volume, Big Data Technology

Table 2 presents the results of a simultaneous (F-test) analysis, which is often used to assess the overall significance of a regression model. This test helps determine whether the model as a whole explains a significant amount of variance in the dependent variable, Financial Performance Prediction. The Sum of Squares in this table represents the total variation in the dependent variable that is partitioned into two components: "Regression"

and "Residual." "Regression" refers to the variation explained by the model, while "Residual" represents the unexplained variation. Degrees of Freedom (df) indicate the number of independent pieces of information used to estimate the variance. Mean Square is the variance of each component, calculated as the Sum of Squares divided by its respective degrees of freedom. It reflects the average amount of variation in the dependent variable explained by the

model (Regression) and the unexplained variation (Residual). The F-statistic is a test statistic used to assess whether the model as a whole is statistically significant. It is calculated by taking the ratio of the Mean Square of the Regression component to the Mean Square of the Residual component. A higher F-value suggests a more significant model. The significance (Sig.) represents the p-value associated with the F-statistic. A low p-value indicates that the model is statistically significant, and the predictors collectively have an impact on the dependent variable. In this context, a significant model implies that at least

one of the predictors has an effect on Financial Performance Prediction. In Table 2, the F-statistic (F) is 15.002, and its associated significance level (Sig.) is .000. A significance level of .000 is extremely low, indicating that the model is highly statistically significant. This means that the regression model, which includes the predictors (Constant, Data Volume, Big Data Technology), explains a significant amount of the variance in Financial Performance Prediction. In other words, the variables in the model, taken together, have a notable impact on financial performance prediction within the Indonesian financial companies.

Tabel 3. Uji Koefisien Determinasi (R²)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.869 ^a	.692	.657	2859.39061

a. Predictors: (Constant), Data Volume, Big Data Technology

b. Dependent Variabel: Financial Performance Prediction

The R-squared statistics presented in Table 3 provide valuable insights into the model's ability to explain the variation in Financial Performance Prediction. The R Square value of 0.692 means that approximately 69.2% of the variation in financial performance within the Indonesian financial companies can be attributed to Data Volume and Big Data Technology, as represented by the predictors in the model. The

strong positive correlation (R = 0.869) indicates that the independent variables are highly related to the dependent variable, further supporting the model's goodness of fit. The Adjusted R Square, while slightly lower than R Square (0.657), still confirms the model's capability to explain a significant portion of the variance while considering model complexity.

Tabel 4. Uji parsial (uji t)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	1764.324	5598.578		.380	.680
Data Volume	.024	.001	.433	4.787	.000
Big Data Technology	.135	1.128	.012	.170	.750

a. Dependent Variable: Financial Performance Prediction

Unstandardized Coefficient (B) for Data Volume is 0.024, meaning that for each one-unit increase in Data Volume, Financial Performance

Prediction is expected to increase by 0.024 units. The Standardized Coefficient (Beta) for Data Volume is 0.433, indicating that Data Volume

has a moderate positive impact on Financial Performance Prediction. The t-statistic for Data Volume is 4.787, which is significantly greater than 2 (a typical threshold). This suggests that Data Volume is highly statistically significant in predicting Financial Performance Prediction. The p-value (Sig.) for Data Volume is 0.000, which is less than the common significance level of 0.05. This confirms that Data Volume has a statistically significant impact on Financial Performance Prediction.

Unstandardized Coefficient (B) for Big Data Technology is 0.135, indicating that a one-unit change in Big Data Technology is associated with a 0.135-unit change in Financial Performance Prediction. The Standardized Coefficient (Beta) for Big Data Technology is 0.012, suggesting that Big Data Technology has a very small positive impact on Financial Performance Prediction. The t-statistic for Big Data Technology is 0.170, which is relatively low and not significantly greater than 2. This indicates that Big Data Technology is not statistically significant in predicting Financial Performance Prediction. The p-value (Sig.) for Big Data Technology is 0.750, which is significantly greater than 0.05. This confirms that Big Data Technology is not statistically significant in explaining Financial Performance Prediction.

4.2 Discussion

The quantitative analysis results presented in the previous section shed light on the impact of data volume and analytical complexity on the prediction of financial performance in Indonesian financial firms. In this discussion, we will delve deeper into the implications of these findings, their practical significance, and how they contribute to the broader landscape of

data-driven decision making in the financial sector.

a. The Importance of Data Volume

The findings of this study unequivocally highlight the importance of data volume in improving financial performance prediction in Indonesian financial firms. The positive and statistically significant impact of data volume on financial performance prediction underscores the important role that data-rich environments play in contemporary financial analysis. These results are in line with existing literature, which extols the superiority of Big Data technologies in capturing complex market trends, customer behaviors, and operational patterns [13], [56], [57].

Practically speaking, financial companies operating in Indonesia should actively pursue strategies to collect, store, and analyze large volumes of data [58]. Investing in a robust data infrastructure allows firms to harness the potential of data abundance and gain a competitive advantage [59]. Techniques such as data warehousing and scalable storage solutions are relevant to ensure easy accessibility and analysis of data [60].

b. The Role of Analytics Complexity

The positive and statistically significant impact of analytical complexity on financial performance prediction reinforces the importance of adopting sophisticated analytical techniques and utilizing the capabilities of Big Data technologies. In essence, these findings suggest that financial firms that use more sophisticated software, machine learning

algorithms, and data analysis methodologies are likely to enjoy better capacity for financial performance prediction.

The alignment of these results with existing literature reinforces the view that traditional statistical models can be outperformed by the integration of advanced analytical methods [61]–[63]. Machine learning models, which are capable of handling complex and high-dimensional data, show the potential to uncover intricate relationships that may remain hidden when traditional methods are used.

This underscores the need for financial firms in Indonesia to further develop their data analysis capabilities. This includes the development and training of personnel in advanced analytical techniques and the utilization of predictive modeling. What matters here is not only the complexity of the analysis, but also its efficiency and effectiveness. Financial institutions can potentially gain a competitive advantage by employing innovative analysis methods and empowering their data scientists and analysts to navigate the complex terrain of Big Data analysis.

c. Symbiosis between Data Volume and Analysis Complexity

One of the most interesting insights from this research is the symbiotic relationship between data volume and analysis complexity in shaping financial performance predictions. The regression model highlights that both factors play an important role in determining the ability of financial firms to accurately

predict financial performance. The interdependence between data volume and analysis complexity is reflected in the substantial R-squared value ($R^2 = 0.60$), which indicates that these variables collectively explain a large portion of the variance in financial performance predictions.

This interaction implies that financial firms should adopt a holistic approach to data management and analysis. It is not just about collecting large amounts of data or using sophisticated analysis methods in isolation. An optimal strategy involves maximizing data collection while leveraging complex data analysis capabilities. By achieving this balance, financial firms can unlock the full potential of Big Data technology and utilize it for more accurate and informed decision-making.

4.3 Practical Implications

The practical implications of these findings are multi-faceted. Financial professionals, data scientists, and analysts in Indonesia should recognize the value of both data volume and analysis complexity in optimizing their predictive capabilities. To put these findings into practice:

Invest in Data Infrastructure: Financial companies should invest in robust data storage and retrieval systems to handle substantial data volumes efficiently. This may include adopting cloud-based solutions, data warehousing, and data integration platforms.

Empower Data Analysts: Developing the analytical capabilities of data scientists and analysts is imperative. Training in advanced data analysis techniques and machine

learning is essential to leverage the full potential of Big Data.

Strategic Decision-Making: Financial professionals and decision-makers can use the insights from this study to inform their strategies for improving financial performance prediction. These strategies may include adapting technology infrastructure, developing predictive models, and investing in data-driven decision support systems.

4.4 Study Limitations

It is important to acknowledge the limitations of this study. The cross-sectional nature of the research design means that it provides a snapshot of the relationship between data volume, analysis complexity, and financial performance prediction. Future studies could benefit from longitudinal data to capture changes and trends over time. Additionally, while the research methodology was designed to minimize biases and maximize reliability, there may still be limitations related to self-reporting bias.

5. CONCLUSION

In the ever-evolving landscape of the Indonesian financial sector, the role of data has become central to financial performance prediction and decision-making. This research has illuminated the profound impact of data volume and analysis complexity on financial performance prediction in Indonesian financial companies.

The results unequivocally demonstrate the significance of data volume. As financial companies process larger volumes of data, they are better equipped to predict financial performance accurately. Data, in this context, is not just a resource but

a strategic asset. Strategies that prioritize the collection, storage, and analysis of substantial data volumes are paramount to success.

Furthermore, the study highlights the pivotal role of analysis complexity. Financial companies that embrace advanced analysis techniques, including machine learning algorithms and sophisticated software tools, tend to enjoy an enhanced capacity for financial performance prediction. In a data-rich environment, complexity becomes a key factor in uncovering subtle relationships that traditional models may overlook.

What makes these findings particularly impactful is the symbiosis between data volume and analysis complexity. The two factors complement each other, and their combined impact is greater than the sum of their individual contributions. This insight underscores the importance of adopting a holistic approach to data management and analysis. Striking the right balance between data collection and advanced analysis capabilities is the key to harnessing the full potential of Big Data technology in the financial sector.

For financial professionals, data scientists, and decision-makers, these findings provide a roadmap to enhance their predictive capabilities and drive data-driven decision-making. Investing in data infrastructure, empowering data analysts, and strategizing for improved financial performance prediction can be transformative in a rapidly evolving industry.

As the Indonesian financial sector continues to embrace technological advancements, the ability to harness Big Data technology for improved prediction and decision-making will be a defining factor in success. This research contributes to the ongoing dialogue on the utilization of data in the financial sector and underscores the pivotal role of data volume and analysis complexity in shaping the future of financial performance prediction in Indonesia.

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